Reilly Industries, Inc.

Indianapolis, IN

Reilly Industries, Inc.
Granite City, Il Facility
Waste Pile and Container Storage Area
Closure Activities Report

Perimeter Soil Sampling and Analysis Results

ENSR Consulting and Engineering

(Formerly ERT)

March 1989

Document Number5660-001

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1. INTRODUCTION

This report presents the results of soil sampling and analysis work conducted around the perimeter of the enclosed waste pile and container storage unit (hereinafter storage unit) at Reilly Industries' Granite City, Illinois tar refinery. The purpose of the sampling and analytical work is to determine the presence of hazardous waste K035 and U051 constituents in the soils around the perimeter of the storage unit which is attributable to its operation. The work described in this report was conducted in accordance with a RCRA closure plan for the storage unit submitted by Reilly Industries on August 31, 1988 and approved by Illinois EPA on November 30, 1988. These results are being submitted to IEPA in accordance with IEPA's November 30 approval letter.

The results of this investigation enable Reilly:

1) to establish soil cleanup standards for polynuclear aromatic hydrocarbons (PAH) for the unit; and,
2) using those standards, to determine the limits of contamination of the surrounding soils as a result of operating the storage unit.

Based upon the determinations above, Reilly is proposing excavation of contaminated materials adjacent to the former hazardous waste management unit to a level consistent with site-specific industrial setting background standards. Upon completion of excavation the material will be disposed of off-site in accordance with applicable hazardous waste disposal regulations. The area of excavation will then be backfilled with clean soil or a compatible construction material and, as necessary, put back into use in accordance with daily operational needs.

2. FIRST ROUND (DECEMBER, 1988) SAMPLING RESULTS

The first round of soil sampling was conducted by ENSR Consulting and Engineering (ENSR) personnel on December 15 and 16, 1988 using the procedures specified in the approved closure plan, except that sampling intervals were changed from twelve-inch to six-inch intervals in the top two feet of material in accordance with the conditions of the IEPA approval letter. The sample locations, which are shown in Figure 2-1 (location numbers S1 through S-10, S-14, -15, -16 and S-18), correspond to those specified in the approved closure plan, except that additional samples (numbers S-14, -15, -16 and S-18) were collected outside the entrance door after visible/olfactory evidence of contamination was found at locations S-9 and S-10. Samples at these additional locations were collected over twelve-inch intervals because of a shortage of sample bottles at this late stage in the sampling program.

Noteworthy field observations made during the sampling effort are as follows:

- No visible or olfactory evidence of contamination was observed at perimeter sample locations S-1 through S-5, S-7 and S-8.
- Traces of small, black, friable carbonaceous particles were observed in the top two samples at location S-6.
- Visible/olfactory signs of contamination were observed at 6-12" at location S-9 and 0-6" at location S-10.
- Samples could not be collected below a depth of 18" at location S-1 or below 12" at location S-9 due to the presence of a concrete foundation.

The analytical results for the first round soil samples are summarized in Table 2-1. Complete results are given in Appendix A. All analyses were conducted by ENSR's Wilmington,

TABLE 2-1

December, 1988 Soil Sampling Results

PARAMETERS\SAMPLE PTS	-	S1A	S1C	S2A	S2B	S2C	S2D	S3A	S3D	S4A	S4D	S5A	S5D
Naphthalene	-	0.6	0.6	9.4	0.6	0.6	0.6	0.6	1.3	0.6	0.6	0.6	0.6
Acenaphthalene	-	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Acenaphthene	-	2.2	0.6	8.8	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6
Fluorene	-	2.5	0.6	12	0.6	0.6	0.6	0.6	0.6	1.2	0.6	0.6	0.6
Phenanthrene	-	11	2.2	100	0.6	0.6	0.6	1.7	0.6	3.3	1.8	1.9	1.3
Anthracene	-	5.2	1.8	69	0.6	0.6	0.6	0.6	0.6	11	0.6	2.4	1.4
Fluoranthene	-	15	4.4	73	0.6	0.6	1.5	3.6	0.6	4.4	3.3	3.6	2
Pyrene	-	11	3.5	45	0.6	0.6	1.2	2.9	0.6	3.2	2.5	2.8	1.5
Benzo(a)anthracene	-	5.7	2.2	20	0.6	0.6	0.6	2.1	0.6	2.5	1.7	1.7	0.6
Chrysene	-	5.2	1.8	19	0.6	0.6	0.6	2.6	0.6	1.3	1.4	1.6	0.6
Benzo(b,k)fluoranthenes	-	9.6	4.1	39	0.6	0.6	1.9	9.7	0.6	4	4.4	3.6	1.8
Benzo(a)pyrene	-	5.1	2.6	14	0.6	0.6	0.6	4.3	0.6	1.5	1.9	2	0.6
Indeno(1,2,3-c,d)pyrene	-	3.7	2.1	11	0.6	0.6	0.6	3.4	0.6	1.3	1.4	0.6	0.6
Dibenzo(a,h,)anthracene	-	0.6	0.6	4.8	0.6	0.6	0.6	1.4	0.6	0.6	0.6	0.6	0.6
Benzo(g,h,i)perylene	-	4.3	2.6	12	0.6	0.6	0.6	3.9	0.6	1.6	1.6	1.5	0.6
Total Carcinogens	-	29.9	13.4	107.8	3.6	3.6	4.9	23.5	3.6	11.2	11.4	10.1	4.8
Total Noncarcinogens	-	52.4	16.9	329.8	5.4	5.4	6.9	15.1	6.1	26.5	12.2	14.6	9.2
Total PAH		82.3	30.3	437.6	9	9	11.8	38.6	9.7	37.7	23.6	24.7	14

Notes: 1) unless otherwise noted, A interval = 0-6", B = 6-12", C = 12-18", D = 18-24"

2) sample 12A is a duplicate of 10A

3) 14B represents the 0-12" interval

4) non-detectable compounds are presented as one-half the detection level

5) 3-methylcholanthene ND in all samples

6) dibenz (a,j) acridine not analyzed for due to absence of method blank

7) carcinogenic PAH compounds = benz (a) anthracene, chrysene, benzo (b&k) fluoranthenes, benzo (a) pyrene, indeno (1,2,3-cd) pyrene and dibenz (a,h) anthracene

8) noncarcinogenic PAH compounds = naphthalene, acenaphthalene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene and benzo (g,h,i) perylene.

TABLE 2-1 (Cont'd)

PARAMETERS\SAMPLE PTS	-	S6A	S6B	S6C	S6D	S7A	S7D	S8A	S8D	S9A	S9B	S10A	S10B
Naphthalene	-	650	2000	5.5	0.6	2.2	0.6	0.6	3.3	0.6	13	0.6	11
Acenaphthalene	-	21	73	0.6	0.6	0.6	0.6	0.6	0.6	0.6	14	7.8	0.6
Acenaphthene	-	140	740	1.4	0.6	1.2	1.3	0.6	3.8	0.6	61	17	4.6
Fluorene	-	140	660	1.1	0.6	3.4	1.3	0.6	4.1	1.4	96	75	5.2
Phenanthrene	-	510	1900	2.2	0.6	6.5	4.5	0.6	12	6	650	170	43
Anthracene	-	61	130	0.6	0.6	22	3.3	0.6	9.4	5.1	100	150	17
Fluoranthene	-	200	570	2.3	0.6	10	9.4	0.6	12	9.3	400	150	88
Pyrene	-	120	290	1.7	0.6	7.2	7.4	0.6	7.8	7.5	190	110	59
Benzo(a)anthracene	-	50	220	0.6	0.6	7.1	6	0.6	4	3.6	93	68	21
Chrysene	-	51	110	0.6	0.6	8.9	3.2	0.6	5.8	3.4	100	69	15
Benzo(b,k)fluoranthenes	-	47	110	2.2	0.6	26	8.3	0.6	9.8	7.1	160	140	22
Benzo(a)pyrene	-	17	4.4	0.6	0.6	11	3.3	0.6	5	3.7	280	65	17
Indeno(1,2,3-c,d)pyrene	-	10	4.4	0.6	0.6	7.5	2.5	0.6	2.9	2.3	130	40	0.6
Dibenzo(a,h,)anthracene	-	3.9	4.4	0.6	0.6	3.9	0.6	0.6	0.6	0.6	5.7	13	0.6
Benzo(g,h,i)perylene	-	10	4.4	0.6	0.6	8	2.8	0.6	2.8	2.5	120	38	0.6
Total Carcinogens	-	178.9	453.2	5.2	3.6	64.4	23.9	3.6	28.1	20.7	768.7	395	76.2
Total Noncarcinogens	-	1852	6367.4	16	5.4	61.1	31.2	5.4	55.8	33.6	1644	718.4	229
Total PAH		2030.9	6820.6	21.2	9	125.5	55.1	9	83.9	54.3	2412.7	1113.4	305.2

TABLE 2-1 (Cont'd)

PARAMETERS\SAMPLE PTS	-	S10C	S10D	S12A	S14B	S14D	S15B	S16B	S16D	S18B
Naphthalene	-	1.2	1.3	170	110	4.8	17	3.5	1.9	8.6
Acenaphthalene	-	0.6	0.6	25	8.9	0.6	2.9	0.6	0.6	0.6
Acenaphthene	-	0.6	0.6	22	48	2.5	4.4	1.7	2.3	0.6
Fluorene	-	0.6	0.6	120	110	4.7	6.7	3.5	2.2	0.6
Phenanthrene	-	6.6	1.6	460	480	18	55	14	15	18
Anthracene	-	2.3	0.6	210	470	11	75	11	6.3	4.5
Fluoranthene	-	8	2.1	400	390	36	89	16	21	20
Pyrene	-	6.4	1.7	270	190	30	75	13	16	16
Benzo(a)anthracene	-	2.9	1.2	170	120	19	33	9.6	13	14
Chrysene	-	3.2	1.4	110	110	16	49	11	16	13
Benzo(b,k)fluoranthenes	-	8	4.1	220	140	20	120	32	35	33
Benzo(a)pyrene	-	4.1	1.6	98	130	16	75	13	16	13
Indeno(1,2,3-c,d)pyrene	-	0.6	0.6	64	81	13	37	10	11	11
Dibenzo(a,h,)anthracene	-	0.6	0.6	29	31	6.4	17	2.8	3.2	4.8
Benzo(g,h,i)perylene	-	0.6	0.6	65	82	15	37	11	11	12
Total Carcinogens	-	19.4	9.5	691	612	90.4	331	78.4	94.2	88.8
Total Noncarcinogens	-	26.9	9.7	1742	1888.9	122.6	362	74.3	76.3	80.9
Total PAH		46.3	19.2	2433	2500.9	213	693	152.7	170.5	169.7

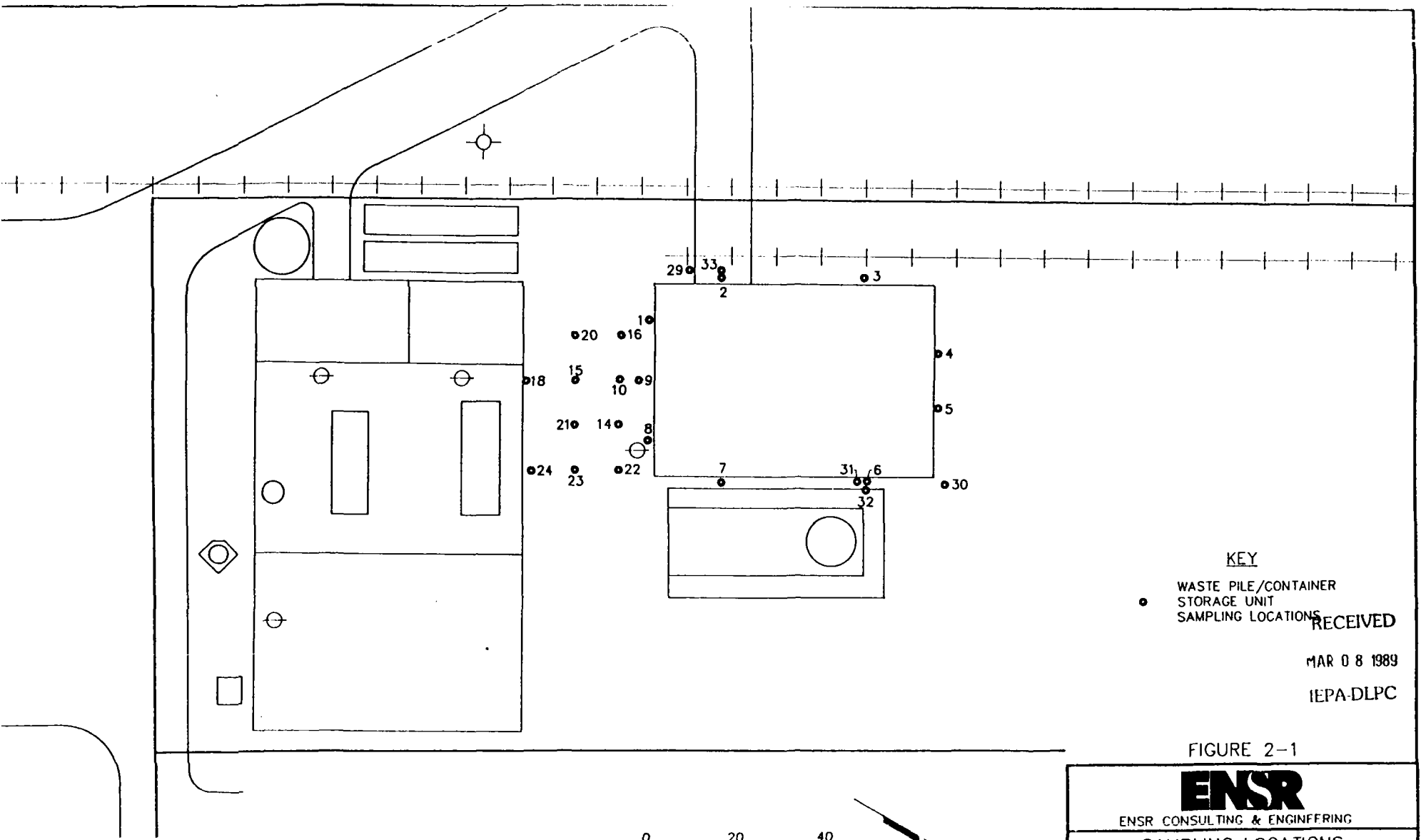

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FIGURE 2-1

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SAMPLING LOCATIONS
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GRANITE CITY, ILLINOIS

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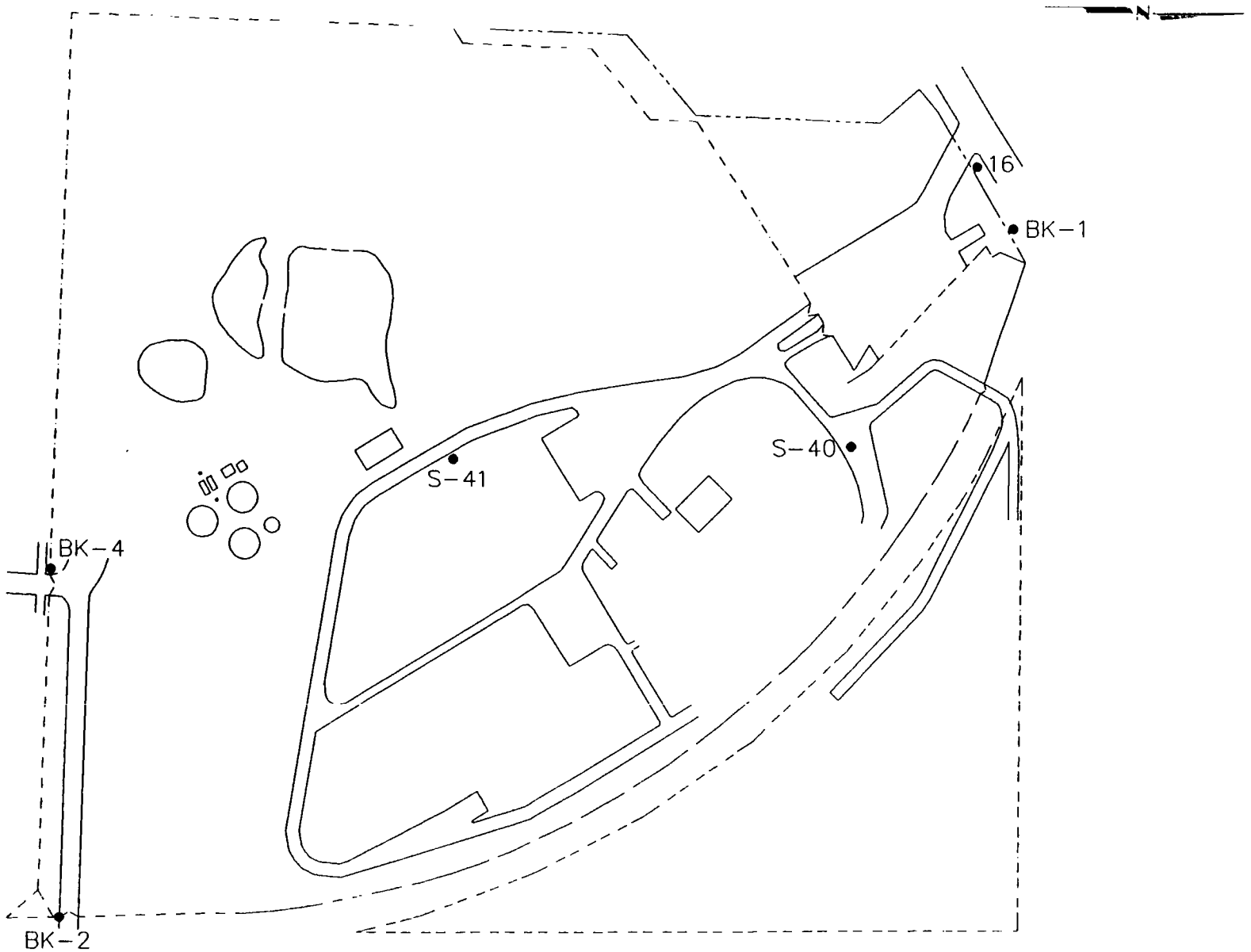
MA laboratory using U.S.EPA SW-846 Method 8270, as specified in the approved closure plan. Analyses were performed initially on the top 6" and bottom 6" intervals from each sample location, with the intervening samples extracted and held for possible later analysis. This approach was agreed to in a telephone conversation between Tod Rowe of IEPA and John Craun of Reilly Industries.

It should be noted that sample S-12A is a duplicate of sample S-10A. Thus no sample point 12 appears on Figure 2-1. Further, when discussing the levels of contamination at S-10A, Reilly is using the average obtained from the anlayses of S-10A and S-12A. Further where an analysis for a specific PAH was below the detection limit (BDL) Reilly is reporting the number in Table 2-1 as half of the detection limit assigned that sample run by ENSR's laboratory.

After the first set of analytical results were received, it was clear that trace, low-ppm level of PAH were present in essentially all samples, including those with no evidence or expectation of contamination from the storage unit. This is consistent with the results of soil sampling conducted for the closure of the surface impoundment at the Granite City facility, which showed trace PAH concentrations detectable in on- and off-site soil samples unaffected by plant operations (see Reilly Tar and Chemical Surface Impoundment Closure and Post-closure Plan (revised) Granite City, Illinois facility, December 1987). Background locations are shown in Figure 2-2. Given these results, it was decided to analyze intervening soil sample intervals around the storage unit only in instances where the 0-6" interval showed concentrations exceeding 150 ppm total PAH, which is the sum of the site-specific noncarcinogenic and carcinogenic background values established and approved previously for the surface impoundment closure. Hence, the extracts from sample intervals B and C (6-12" and 12-18", respectively) were analyzed at locations S-2, S-6 and S-10; at the other locations samples from these intervals were discarded.



LEGEND

Approximate
• Background Soil
Sample Location

ENSR.
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ROADWAY BACKGROUND SOIL
SAMPLING LOCATIONS
REILLY INDUSTRIES

FIGURE NUMBER
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3. SECOND ROUND (JANUARY, 1989) SAMPLING RESULTS

The results from the first round of soil sampling and analysis indicated that there were elevated PAH concentrations at locations S-2 and S-6 and at the front of the entrance door. A second round of sampling and analysis was therefore conducted in order to determine the limits of contamination in these areas. Additional samples were collected at 0-6" and 6-12" intervals around locations S-2 and S-6 to determine the limits of contamination along the southwest and northeast walls of the waste pile building (sample numbers S-29 through S-33; see Figure 2-1). Additional samples at 0-6" and 6-12" intervals were also collected on a ten-foot grid pattern around the entrance to the waste pile building (sample numbers S-20 through S-24; see Figure 2-1).

The presence of PAH around the entrance to the waste pile building posed a problem in designing a sampling and analysis plan to determine PAH contamination attributable to the operation of the storage unit. The waste pile building entrance is located on a plant roadway, and the construction of the roadway and its routine use for other plant production purposes make it difficult to distinguish between PAH contamination resulting from the operation of the storage unit and PAH merely present from the road materials and other uses of the road. The roadway is constructed of gravel and cinders, and background soil sampling conducted during the surface impoundment closure has shown that cinder materials can contain PAH (see Surface Impoundment Closure Plan (Revised)). Moreover, the roadway has been in use for over 50 years for travel of trucks and heavy equipment, often hauling coal tar materials and products, which are comprised primarily of PAH compounds. In order to address the problem of distinguishing PAH attributable to the storage unit operation from PAH resulting from other non-waste related roadway uses and the roadway's construction, background samples were collected from two in-plant roadways some distance away from the waste pile

area at 0-6" and 6-12" intervals (locations S-40 and S-41; see Figure 2-2). Neither of these in-plant roadways are used for in-plant movements of hazardous wastes, and both background roadway sampling locations are well removed from hazardous waste generation sources.

The overall approach for the second round of sampling was discussed with IEPA during a meeting held on January 17, 1989 between ENSR, IEPA and Reilly personnel. The second round of samples were then collected by ENSR and Reilly personnel on January 8, 1989 using the procedures specified in the approved closure plan, and following the overall approach discussed earlier with IEPA. Noteworthy field observations during the second sampling round include the following:

- Further digging at location S-6 indicated traces of a tan-colored crystalline material with a naphthalene-like odor.
- No visible or olfactory evidence of contamination was seen in the additional samples collected around locations S-2 and S-6.
- The additional samples collected around the building entrance in the plant roadway generally showed compacted gravel and cinders in the approximately 0-6" interval, with the underlying cinder materials stained black.

The analytical results for the second round soil samples are summarized in Table 3-1. As in Table 2-1, contaminants which were BDL are assigned half of the detection limit for that sample. Complete results are given in Appendix B. All analyses were conducted by ENSR's Wilmington, MA laboratory using U.S. EPA SW-846 Method 8270. Additional contingent samples that were collected farther out from the waste pile building at locations S-2 and S-6 and farther out from the building entrance were extracted and held for possible subsequent analysis, but these extracts were discarded after the second round analytical results were received and evaluated.

TABLE 3-1

January, 1989 Soil Sampling Results

PARAMETERS\SAMPLE PTS	-	S20A	S20B	S21A	S21B	S22A	S22B	S23A	S23B	S24A	S24B	S29A	S29B
Naphthalene	-	3	70	2	17	1.6	12	1.1	28	75	16	0.6	0.6
Acenaphthalene	-	0.6	2.8	0.6	2.5	0.6	2.6	0.6	2.6	3	2.9	0.6	0.6
Acenaphthene	-	1.3	39	1.3	6.1	0.6	2.6	0.6	14	18	2.9	0.6	0.6
Fluorene	-	2	14	1.2	12	0.6	7.5	1	2.6	6.4	2.9	0.6	0.6
Phenanthrene	-	8.3	300	5.3	38	5.5	36	4.2	38	88	24	2.3	1.9
Anthracene	-	10	74	4.9	37	3.4	22	2.8	17	39	9	0.6	0.6
Fluoranthene	-	58	420	12	54	16	68	8.5	140	140	38	5.3	7.7
Pyrene	-	48	310	8.3	44	12	57	6.7	250	100	35	4.2	6.3
Benzo(a)anthracene	-	19	130	7.1	36	9.8	39	5.7	100	92	23	3.6	9.7
Chrysene	-	12	67	8.2	30	6.9	40	4.2	35	37	24	1.8	6.7
Benzo(b,k)fluoranthenes	-	33	180	20	78	20	90	9.7	170	120	44	4.2	28
Benzo(a)pyrene	-	9.1	51	7.8	31	7.4	44	4.5	55	38	25	1.7	8.3
Indeno(1,2,3-c,d)pyrene	-	9	51	7.4	26	6.4	33	3.4	42	45	25	1.2	9.3
Dibenzo(a,h,)anthracene	-	4	19	3.8	2.5	3	14	0.6	32	25	9.8	0.6	4.8
Benzo(g,h,i)perylene	-	10	48	7.2	26	7.3	38	3.7	43	58	28	1.4	11
Total Carcinogens	-	86.1	498	54.3	203.5	53.5	260	28.1	434	357	150.8	13.1	66.8
Total Noncarcinogens	-	141.2	1277.8	42.8	236.6	47.6	245.7	29.2	535.2	527.4	158.7	16.2	29.9
Total PAH		227.3	1775.8	97.1	440.1	101.1	505.7	57.3	969.2	884.4	309.5	29.3	96.7

Notes: 1) unless otherwise noted, A interval = 0-6", B = 6-12", C = 12-18", D = 18-24"

2) sample 12A is a duplicate of 10A

3) 14B represents the 0-12" interval

4) non-detectable compounds are presented as one-half the detection level

5) 3-methylcholanthene ND in all samples

6) dibenz (a,j) acridine not analyzed for due to absence of method blank

7) carcinogenic PAH compounds = benz (a) anthracene, chrysene, benzo (b&k) fluoranthenes, benzo (a) pyrene, indeno (1,2,3-cd) pyrene and dibenz (a,h) anthracene

8) noncarcinogenic PAH compounds = naphthalene, acenaphthalene, acenaphthene, fluorene, phenanthrene, anthracene, fluoranthene, pyrene and benzo (g,h,i) perylene.

TABLE 3-1 (Cont'd)

PARAMETERS\SAMPLE PTS	-	S30A	S30B	S31A	S31B	S32A	S32B	S33A	S33B	S40A	S40B	S41A	S41B
Naphthalene	-	0.6	0.6	0.6	0.6	1.3	0.6	0.6	0.6	2.5	2	19	17
Acenaphthalene	-	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	2.5	0.6	2.5	2.7
Acenaphthene	-	0.6	0.6	0.6	0.6	1.2	2.4	0.6	0.6	2.5	1.2	11	2.7
Fluorene	-	1.3	0.6	0.6	0.6	3.7	2.9	0.6	0.6	2.5	1.5	11	2.7
Phenanthrene	-	5.6	4.3	4.7	2	12	8.5	1.5	3.7	28	7.1	46	35
Anthracene	-	3.6	2.3	3	0.6	9	2.5	1	1.2	9.9	4	31	54
Fluoranthene	-	9.5	7.4	7	3.8	18	8.1	3.7	5.4	76	15	75	85
Pyrene	-	6.9	5.5	5.6	3	12	5.1	2.9	3.9	63	11	61	73
Benzo(a)anthracene	-	5	3.7	2.3	2.3	9	2.4	1.9	3.2	84	10	58	95
Chrysene	-	3.4	2	2.6	1.3	7.3	1.2	0.6	1.7	69	6.9	53	57
Benzo(b,k)fluoranthenes	-	8	3.7	6.3	4	13	1.5	0.6	5.5	200	23	160	210
Benzo(a)pyrene	-	3.2	1.7	2.4	1.8	4	0.6	0.6	2.3	86	7.9	64	75
Indeno(1,2,3-c,d)pyrene	-	2.1	0.6	1.9	1.2	2.7	0.6	0.6	1.9	94	7.8	59	61
Dibenzo(a,h,)anthracene	-	0.6	0.6	0.6	0.6	0.6	0.6	0.6	0.6	47	0.6	29	33
Benzo(g,h,i)perylene	-	2.4	1.2	2.1	1.5	2.9	0.6	0.6	1.9	100	8.8	69	70
Total Carcinogens	-	22.3	12.3	16.1	11.2	36.6	6.9	4.9	15.2	580	56.2	423	531
Total Noncarcinogens	-	31.1	23.1	24.8	13.3	60.7	31.3	12.1	18.5	286.9	51.2	325.5	342.1
Total PAH		53.4	35.4	40.9	24.5	97.3	38.2	17	33.7	866.9	107.4	748.5	873.1

4. PHYSICAL OBSERVATIONS OF PERIMETER SAMPLES AND ESTABLISHMENT OF CLEANUP STANDARDS

Perimeter samples of surface and near-surface materials at the storage unit revealed that those materials fall into two general categories, corresponding to their locations about the building. Along the west, north and east sides, as well as the south wall on either side of the building entranceway, materials sampled may be categorized as soil. However, at the building entrance and along the south side other than immediately adjacent to the wall, materials sampled were logged as road-base fill and cinders (see Table 4-1).

This finding of distinctly different type materials (soil vs. fill/cinders) suggested distinctly different historical patterns of industrial use around the storage unit. Where soil is found (west, north and east sides), past activities have likely been low use/low impact; where fill/cinders are found (entranceway and adjacent plant roadway), past industrial use has been high and consequently, higher impacts are expected. Analytical results confirm a correlation between historical usage and levels of PAH. However, these results do not in themselves indicate impact solely by hazardous waste management activities.

To establish whether PAH in the roadway resulted from spillage and/or dragout of hazardous waste, additional background samples from in-plant roadways (S-40 and S-41) were collected. Sample results from the uppermost one foot of material at S-40 and S-41 showed levels of PAH in the range of those found in the uppermost one foot outside the building entranceway. Yet S-40 and S-41 were collected from areas of the plant where hazardous waste had never been handled. At that point it became evident that levels of PAH encountered outside the entrance to the storage unit were not entirely contributed by hazardous waste materials.

TABLE 4-1

SECOND ROUND SAMPLE DESCRIPTIONS

Sample #	Interval	Description
20a	0-6"	fill/soil
20b	6-12"	black cinders
21a	0-6"	fill
21b	6-12"	cinders
21c	12-20"	cinders
22a	0-6"	fill
22b	6-12"	fill
23a	0-6"	fill
23b	6-12"	cinders
24a	0-6"	black cinders
24b	6-12"	black cinders
29a	0-6"	slag
29b	6-12"	soil
30a	0-6"	soil
30b	6-12"	soil
31a	0-6"	soil
31b	6-12"	soil
32a	0-6"	slag
32b	6-12"	slag
33a	0-6"	slag
33b	6-12"	soil
40a	0-6"	black fill
40b	6-12"	black fill/cinders
40c	12-24"	black cinders
41a	0-6"	fill
41b	6-12"	fill/cinders
41c	12-18"	cinders

Given the inability of laboratory analyses alone to distinguish among the origins of PAH found outside the building entranceway, other avenues for determining extent of contamination were researched. Earlier sampling and analytical work (background sample 14A) during the overflow area closure exercise had shown the presence of cinder materials underlying soil in non-manufacturing areas of the site (i.e., an apparently acceptable background location) and the presence of PAH in those cinder materials. During sampling in the roadway south of the storage unit and in the additional background roadway sampling locations cinders also were found, generally overlain by fill material. Logs of the hand borings shown in Table 4-1 confirm this general trend in all roadway samples.

In addition, review of data included in Table 3-1 generally indicate a lower-to-higher progression of PAH levels with depth (i.e., the A horizon to the B horizon) for roadway samples. However, contamination resulting from any surface source such as spillage or dragout during operation of the storage unit should generally show a higher-to-lower progression. This is true because the materials handled in the waste pile were low mobility solids such as contaminated soils.

Thus, Reilly concluded that a two-stage approach was most appropriate in determining cleanup standards:

- Where soils are present a cleanup standard and approach essentially equivalent to that for the overflow area and surface impoundment will be followed;
- Where roadway material was encountered a modified cleanup standard should be used that accounts for the following features:
    - the physical characteristics of hazardous waste managed at the unit and the waste's migration potential;

- operational practices in the storage unit;
- operational practices across the plant as a whole (e.g., production, transportation, etc.);
- PAH concentration with depth; and
- subsurface materials encountered with depth.

The cleanup approach for soils is discussed in Section 5 and the cleanup approach for roadways is addressed in Section 6.

5. SOIL CLEANUP STANDARDS

The site-specific soil cleanup standard approved by IEPA in its June 20, 1988 approval letter for the surface impoundment closure at the Granite City facility was 50 ppm total noncarcinogenic PAH and 100 ppm total carcinogenic PAH. This cleanup standard was obtained from the mean plus 95% confidence interval of the results from seven on- and off-site background samples. These samples ranged from native loam soils to gritty, cindery soils collected along road shoulders. The results from the in-plant roadway background samples collected during the second sampling round make it clear that the previous cleanup standard can not be applied to the roadway in front of the waste pile building, since the two in-plant roadways -- sampled in areas well removed from hazardous waste operations at the plant -- generally yielded total PAH concentrations in the range of 800 ppm (see Table 3-1 results for locations S-40 and S-41).

Reilly Industries will therefore use a two-stage approach for establishing cleanup standards for the storage unit. First, a slightly modified version of the earlier site-specific soils cleanup standard will be used for the west, north and east sides of the waste pile building (i.e., those areas with soils unaffected by site roadway construction materials and uses). Second, a site-specific roadway cleanup standard based on the results of roadway background samples will be used for the plant roadway area along the south side (the entrance side) of the waste pile building. Further details of this two-stage approach for soils are provided below. Details for the roadway are provided in Section 6.

In evaluating the two-stage cleanup standards, future activities to be conducted at the site should be considered. With respect to the waste pile/container storage unit, hazardous waste management activities will cease. Reilly is proposing to remove PAH contamination potentially resulting from operation of the storage unit down to background levels

establishing clean closure over the rest of the site. This closure by removal will be completed for all portions of the building not affected by roadway construction and materials (i.e., the west, north and east sides). The only exception is the area immediately outside the entrance, which has historically been an area not of waste management but rather of day-to-day production activities, and an area which is not composed of native soil material but rather of PAH-contributing cinder materials. Even in this area, Reilly has calculated a worst-case contribution of PAH from waste management operations.

As noted above, the previously established site-specific soil cleanup standard for the surface impoundment closure is 50 ppm total noncarcinogenic PAH and 100 ppm total carcinogenic PAH. Reilly Industries proposes to modify this standard slightly to be 150 ppm total PAH, provided that total carcinogenic PAH is still less than 100 ppm. This revised standard is still based on the results of earlier site-specific background sampling, but is adjusted to reflect the fact that PAH molecular weight profiles, and the corresponding distribution between noncarcinogenic and carcinogenic PAH, may vary from one location to another depending on the types of anthropogenic inputs received and the weathering history of the location. However, the health risks associated with carcinogenic PAH are much more severe than those associated with noncarcinogenic PAH, so that the background-based limit of 100 ppm for total carcinogenic PAH is still maintained. Reilly Industries proposes to use this modified, site-specific background cleanup standard of 150 ppm total PAH and 100 ppm total carcinogenic PAH for soils along the the west, north and east sides of the waste pile building. Table 5-1 summarizes this proposed soil cleanup standard.

TABLE 5-1

PROPOSED CLEANUP STANDARDS - SOILS*

Standard (in ppm)			**Background
Total PAH	Total Carcinogenic PAH	Basis	Examples Used
150	100	Mean plus 95% confidence interval of site specific background samples	15, 16, BK1, BK2, BK3, BK4, BK5

*Standards apply to areas west, north and east of the waste pile/container storage building

**Represent 0-12" interval from September and November, 1987 sampling exercises

6. ROADWAY CLEANUP STANDARDS

During closure sampling activities roadway type materials were encountered at the entranceway to the storage unit and in the adjacent roadway. Sampling of these materials both at depth and with distance from the storage unit indicates the following:

- in general, the roadway consists of slag and gravel fill material in the upper six inches followed at depth by black fill and cinders; and,

- PAH are low mobility compounds which tend to concentrate and adsorb to soil in the uppermost intervals nearest to the point of deposit and which decrease markedly in concentration with depth. The initial five background location samples confirm this finding of progressive higher-to-lower change in concentration. However, with two exceptions, roadway samples show concentration changes of lower-to-higher with greater depth.

The Granite City facility is approximately sixty years old, and the roadway which transverses the production area in front of the storage unit is a major feature of the facility, used for transport of regulated hazardous waste (since 1981), raw and intermediate material, and product. The roadway is believed to have existed for the major portion of facility operations; certainly the roadway preexisted the storage unit by many decades. According to the plant manager, no major construction events relative to the roadway have occurred for at least 11 years. In other words, cross-sectional structure as determined by review of the hand borings has not been modified for at least that period of time. In general, the roadway profile appears to be an uppermost 6" layer of gravel and slag fill underlain by black fill/cinders. These

underlying materials are consistent with those found elsewhere on the site, including previous background soil sample location 14 and solid waste management unit (SWMU) test pits southeast of the surface impoundment. Previous analytical work has shown cinders to contain significant levels of PAH, even in areas of the site which have never been the site of production operations (e.g., background soil sample location 14). Thus, the roadway subgrade appears to be consistent with other areas of the site which apparently are largely fill material.

All production feedstock, intermediate, product and hazardous waste materials at the Reilly facility contain PAH. While hazardous waste transportation activities have been limited to known routes within the facility, transport of feedstock, intermediate and product material has not. All may have contributed to the presence of PAH in the roadway outside the storage unit. Analytical results are incapable of assigning responsibility by contribution, however.

A review of hazardous waste activities at the storage unit indicates the following:

- the hazardous wastes stored within (and transported into and out of) the storage unit were thick, non-free liquid, non-mobile materials consisting mainly of contaminated soils. Any spills were not likely to migrate rapidly into the roadway materials but rather mix with the surface fill at the surface;

- transportation of hazardous wastes from point of generation to point of storage followed specified routes;

- when hazardous waste was transported into or out of the storage unit, standard operational housekeeping practices included scraping the area immediately outside the door to minimize trackout. These materials were then transported with the wastes for off-site disposal. This practice of removing

potentially contaminated material at the surface explains the progression of PAH levels at sample location 9. Horizon 9B indicates contamination not from the storage unit but rather from historical non-waste management activities; and,

- operations records do not reflect the occurrence of a major spill from the building into the entranceway and adjacent roadway.

Accordingly, application of cleanup standards developed for areas of the facility outside normal plant production areas is inappropriate. Rather, areas such as that outside the storage unit doorway highlight the need for a specific cleanup standard reflective of past and planned future operational practices. Two options exist for addressing this need and are explained in detail in the following sections.

In-Plant Roadway Background Standard

Recognizing past and future uses of the roadway for transport of feedstock, intermediate and product materials, a cleanup standard consistent with existing PAH levels at roadway sampling locations S-40 and S-41 is appropriate. Such a cleanup standard sets a site-specific, area-specific (i.e., production roadway area) background based on existing roadway levels away from the building. This approach attributes levels above those standards to operation of the storage unit and proposes excavation and removal of materials above the cleanup standard.

Reilly has calculated in-plant roadway-specific cleanup standards of 810 ppm total PAH and 500 ppm total carcinogenic PAH as shown in Table 6-1. These standards were set based upon levels of PAH encountered in the uppermost interval (0-6") at sample locations S-40 and S-41. As explained earlier, the finding of cinders at deeper (6" and below) intervals

TABLE 6-1

PROPOSED CLEANUP STANDARD - ROADWAY*

Option 1 - In-Plant Roadway Background Standard

Standard (in ppm)			
Total PAH	Total Carcinogenic PAH	Basis	Background Examples Used
810	500	Average of results obtained at 0-6" interval	S-40A, S-41A

Option 2 - General Roadway Background Standard

Standard (in ppm)			
Total PAH	Total Carcinogenic PAH	Basis	Background Examples Used
730	460	Mean plus 95% confidence interval of on- and off-site roadway background samples	16, BK-1A, BK-2A, BK-4A, S-40A, S-41A

*Standards apply to roadway and entrance areas south of the waste pile/container storage building

correlates with the surface impoundment SWMU investigation and other site work. Thus clean closure of the storage unit on the south side only will entail removal of materials within the calculated extents of contamination using the bounding approach approved for the overflow area. Calculations will not address materials below the 0-6" interval which are related to plant roadway construction material and plant operations. However, to account for sample S-14B which represented 0-12" rather than 6-12" and to be conservative, excavation depth will be 12", including the area immediately outside the building doorway. Calculated excavation limits will be presented in Section 7.

General Roadway Background Standard

As an option to evaluating only in-plant roadway sample results, the existing site-specific background numbers may be combined with additional background values to generate a general roadway background standard. This general roadway background reflects PAH values from high-use roadways in the production area, from samples taken adjacent to low-use on-site roadways, and from samples taken adjacent to off-site roadways in publicly accessible areas.

This approach incorporates both 0-12" and 0-6" sampling intervals, reflecting both changes in Agency policy for collection of background samples (locations 16, BK-1A, -2A and BK-4A were all specified to be 0-12"; 40A and 41A were specified to be 0-6") and the finding of slag and gravel underlain by cinder materials at locations S-40 and S-41. Using these values shown in Table 6-2 to calculate the mean plus 95% confidence interval, Reilly has determined the general roadway background standards to be 730 ppm total PAH and 460 ppm total carcinogenic PAH, as shown in Table 6-1. Having generated these cleanup standards Reilly will once again apply the bounding approach used for the overflow area to calculate extent of contamination and consequent area of material to be excavated in Section 7. Excavation will be limited to

TABLE 6-2

DERIVATION OF SITE-SPECIFIC

PLANT ROADWAY BACKGROUND STANDARD

Sample No.	Collection Date	Noncarcin. PAH	Carcin. PAH	Total PAH	Description
:6A	9/87	55	53	108	top 1' along shoulder of Edwardsville Rd.
BK1A	11/87	47	42	89	top 1' along shoulder of Edwardsville Rd.
BK2A	11/87	57	165	222	top 1' along shoulder of plant road at SE gate.
BK4A	11/87	22	31	53	top 1' along shoulder of plant road at SE gate.
40 A	1/89	287	580	867	0-6" interval in middle of plant roadway.
41 A	1/89	326	423	749	0-6" interval in middle of plant roadway.
Averages - In-Plant Roadway Background (S-40 and S-41) Option			500	810	
Statistical Summary - General Roadway Background Option					
Mean			216	348	
Std. Dev.			232	363	
t 95%, 5 d.f.			2.571	2.571	
95% CI			244	381	
Mean + 95% CI			460	730	

potentially affected surface materials and will not address non-hazardous waste related pitch or roadway construction cinders.

This report provides calculated cleanup standards for roadway materials as well as calculated limits of excavation using both an in-plant roadway background standard and a general roadway background standard approach. Reilly believes either approach is appropriate, and is presenting them as options to the Agency for approval. Reilly's proposed background standards incorporate data from heavily used production areas (samples S-40 and S-41) alone, or in conjunction with lightly used production areas (samples BK-2A and BK-4A) and off-site roadways (samples 16A and BK-1A). The inclusion of numbers lower than those evidenced by the major production area roadways is a conservative approach which results in a lower roadway cleanup objective than one using in-plant roadway background only.

While no significant activities are planned for the areas west, north and east of the waste pile building, the roadway south of it will likely continue to be used for transport of production materials, equipment, and products for the life of the facility. As in the past, PAH contributing material such as slag, cinders or asphaltic road materials will be used in maintenance of the roadway. Closure of the regulated unit in areas where its operation overlaps production operations will be to standards equal to or less than levels present in non-regulated production areas of the plant. The two-stage cleanup standards, which are based upon actual background situations, and which recognize past and future activities of an ongoing production operation, constitute site-specific industrial background.

Upon Agency approval of either option as presented herein, Reilly will complete closure activities in accordance with Section 7 of this document and the approved August 1988 closure plan.

7. MATERIAL EXCAVATION LIMITS

Comparing the results of the soil samples collected around the perimeter of the waste pile/container storage unit with the site-specific cleanup standards given in Table 4-2 shows that the following samples exceeded the applicable cleanup standards:

South end of west wall = S-2A
North end of east wall = S-6A&B
Roadway/entrance area = S-10A/12A, S-14B, S-24A

Sample locations, material encountered and PAH levels are summarized in Tables 7-1 and 7-2.

As explained previously and confirmed by visible and analytical evidence, B-horizon materials (i.e., those below a depth of 6") outside the building entrance and in the roadway are PAH-contributing cinder materials. PAH levels in that horizon are related not to the waste management unit but rather to historical road construction and production practices. The roadway in front of the waste pile building has not been replaced or added to since the waste pile building was installed. Given the physical state of waste in the storage building, it is very unlikely that PAH migrated down from a surface spill of hazardous waste material. Accordingly, PAH contaminant delineation and removal focuses on potentially impacted surface (0-6" interval) materials and excludes deeper intervals. Thus, PAH levels in B-sample points are not related to the RCRA closure and should be left in place.

As explained previously, samples associated with closure of the storage unit were generally collected at 6" intervals, allowing depth discrete comparisons of PAH levels. However, sample 14B included the entire upper 12" interval. Thus, levels of PAH in the upper 6" cannot be distinguished from levels in the lower 6". Therefore, B-horizon materials, while not believed related to the RCRA closure, will nevertheless be removed at all locations within the excavation area.

TABLE 7-1

SAMPLE LOCATIONS ALONG WEST, NORTH AND EAST SIDES OF
WASTE PILE/CONTAINER STORAGE BUILDING EXCEEDING BACKGROUND

Sample Location	Total PAH	Total Carcinogenic PAH
S-2A	438	108
S-6A	2031	179
S-68	6821	453

TABLE 7-2

SAMPLE LOCATIONS SOUTH OF WASTE PILE/CONTAINER STORAGE BUILDING EXCEEDING CLEANUP STANDARDS

Sample Location	Material	PAH Concentration (in ppm) Total PAH	Total Carcinogenic PAH
10A/12A average	sand visible contam. with black chunks	1773	543
14B*	sand visible contam. with black chunks	2501	612
24A	black cinders	884	357

*For samples S-14, -15, -16 and S-18, B designation indicates sample collected at 0-12"; no discrete A (0-6") interval exists

Note: samples included herein exceeded both in-plant roadway and general roadway background standards

The only A interval sample exceeding cleanup standards besides S-10A/12A was S-24A. However, that location:

- is over 30 feet from the storage unit entranceway and well outside the normal traffic pattern for addition or removal of waste from the unit;
- is adjacent to the plant boiler house and at the edge of the roadway;
- is outside intervening clean samples at locations S-21 and S-23; and,
- yielded a sample consisting of black cinders.

This location is indicative of in-plant roadway conditions, not of an area impacted by operation of the storage unit. Consequently, location S-24 is not part of the RCRA closure and is not addressed in this program.

This section proposes excavation limits for each of these three areas based on the approach outlined in Section 5.4 of the approved closure plan for the waste pile/container storage unit. Under this approach, the rate of change in PAH concentrations with distance between contaminated and uncontaminated locations is calculated (in ppm/ft) and used to determine the distance from the contaminated location at which the cleanup standard is achieved.

West, North, and East Sides of Building

Table 7-3 summarizes the calculations made to determine the excavation limits for the two areas along the sides of the waste pile building. At both areas, total PAH concentrations establish larger excavation limits than total carcinogenic PAH results, and the larger limits will be used. At location S-2, the top 6 inches of soil will be excavated within the defined area, since the underlying samples were all well below the cleanup standard. At location S-6, the top 12 inches will be excavated. The areas to be excavated are shown in Figure 7-1.

TABLE 7-3

DETERMINATION OF EXCAVATION LIMITS

ALONG THE WASTE PILE BUILDING SIDES

Sample Location	PAH Concentrations Carcin.	Total	Distance from Point of Concern	Rate of PAH Decrease (ppm/ft) Carcin.	Total	Distance to Standard (ft) Carcin. (100 ppm)	Total (150 ppm)
S-2A	108	438	NA	NA	NA	NA	NA
S-29A	13	29	7' south	14	59	0.6	4.9
S-33A	5	17	2' west	52	210	0.2	1.4
S-3A	24	39	27' north	3.1	15	2.6	19
S-6A	179	2031	NA	NA	NA	NA	NA
S-32A	37	97	2' south	71	967	1.1	2.0
S-31A	16	41	2' east	83	996	1.0	1.9
S-30A	22	53	17' north	9.2	116	8.6	16
S-6B	453	6821	NA	NA	NA	NA	NA
S-32B	7	38	2' south	223	3392	1.6	2.0
S-31B	11	24	2' east	221	3398	1.6	2.0
S-30B	12	35	17' north	26	399	14	17

NOTE: Applicable clean-up standard is 150 ppm total PAH and 100 ppm total carcinogenic PAH.

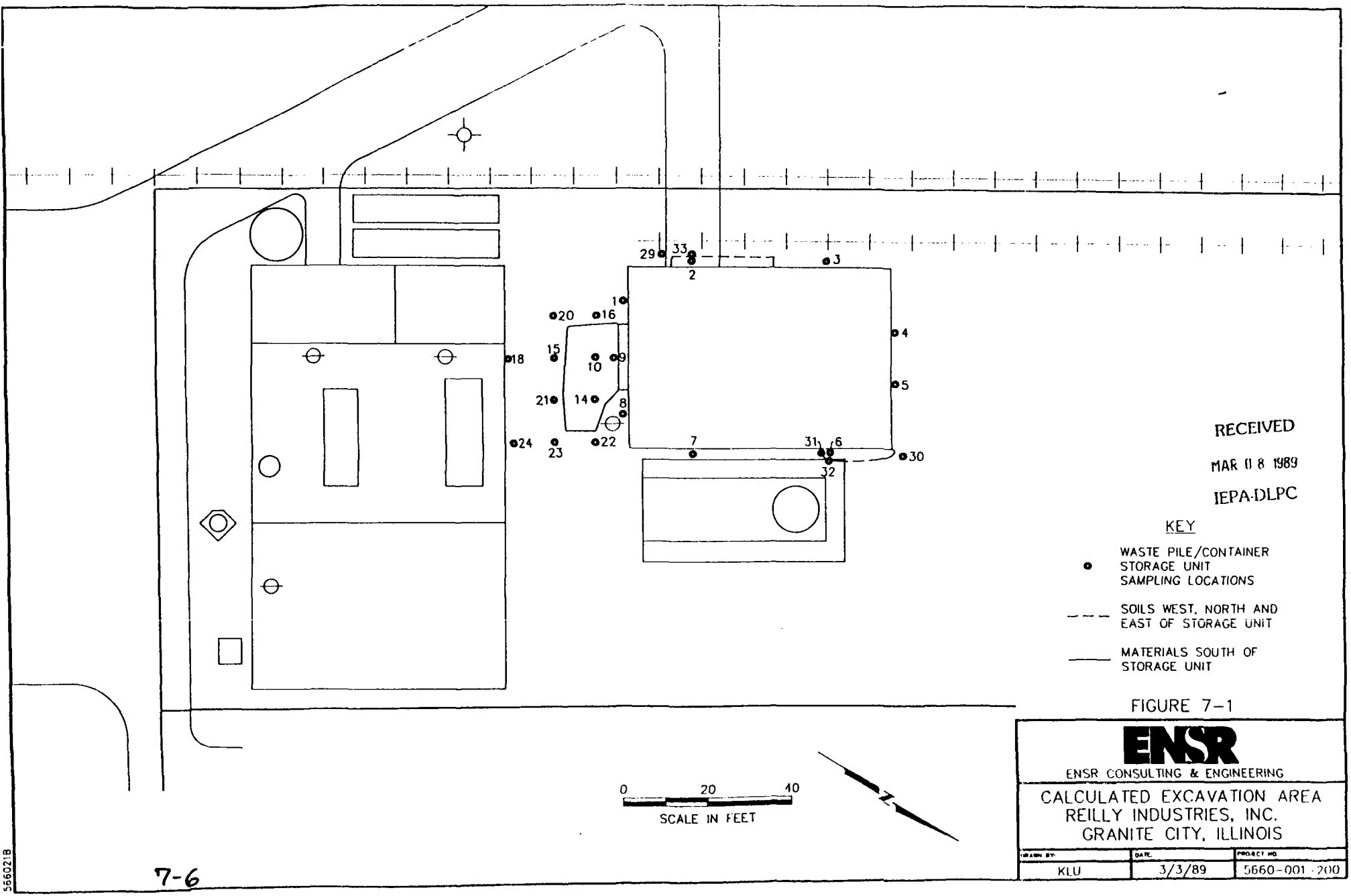

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FIGURE 7-1

ENSR CONSULTING & ENGINEERING

CALCULATED EXCAVATION AREA
REILLY INDUSTRIES, INC.
GRANITE CITY, ILLINOIS

DRAWN BY	DATE	PROJECT NO.
KLU	3/3/89	5660-001-200

7-6

5660218

South Side of Building

Tables 7-4 and 7-5 summarize the calculations made to determine the excavation limits for the area around the entrance to the waste pile/container storage building location S-10A and location 14B, for which depth discrete (A vs. B) samples were not collected. Only the standard for total PAH was exceeded, and the excavation limits are based on that standard alone. The resulting excavation area, shown in Figure 7-1, uses the edges of the entrance door to help establish the excavation boundaries. This is consistent with the hypothesis that the elevated PAH concentrations seen in the surface samples around the entrance (i.e., at location S-10A) reflect drag-out of hazardous waste constituents during operation of the waste pile. To be conservative, the area shown in Figure 7-1 will be excavated to a depth of twelve inches. In any event, the sample collected below twelve inches at location S-10 gave results well below the clean-up standard.

Excavation limits for the storage unit closure will vary slightly for the area outside the building entrance depending upon the background value, either 500/810 or 460/730 ppm total carcinogenic PAH/total PAH, chosen for that limited area. Both approaches are calculated in Tables 7-4 and 7-5, respectively. Due to the only slight difference in excavation limits using either approach, the layer of the two is presented in Figure 7-1.

TABLE 7-4

DETERMINATION OF EXCAVATION LIMITS SOUTH OF BUILDING USING

IN-PLANT ROADWAY BACKGROUND STANDARDS

Sample Location	PAH Concentrations (ppm) Total Carc. PAH	Total PAH	Distance (ft) from Point of Concern	Rate of PAH Decrease (ppm/ft) Carc. PAH	Total PAH	Distance to Standard (ft) Carc. (500 ppm)	Total (810 ppm)
S-10A/S-12A	543	1773	NA	NA	NA	NA	NA
S-9A	21	54	4' north	130	430	.3	2.2
S-20A	86	227	14' west	33	110	1.3	8.8
S-21A	54	97	14' south	35	120	1.2	8.0
S-1A	30	82	15' west	34	113	1.3	8.5
S14B	612	2501	NA	NA	NA	NA	NA
S-8A	4	9	8' north	152	623	.7	2.7
S-21A	54	97	10' south	56	240	2	7.0
S-22A	54	101	10' east	56	240	2	7.0
S-23A	28	57	14' east	42	175	2.7	9.7

Note: Applicable cleanup standard is 810 ppm total PAH and 500 ppm total carcinogenic PAH.

TABLE 7-5

DETERMINATION OF EXCAVATION LIMITS SOUTH OF BUILDING USING GENERAL ROADWAY BACKGROUND STANDARDS

Sample Location	PAH Concentrations (ppm) Total Carc. PAH	Total PAH	Distance (ft) from Point of Concern	Rate of PAH Decrease (ppm/ft) Carc. PAH	Total PAH	Distance to Standard (ft) Carc. (460 ppm)	Total (750 ppm)
S-10A/S-12A	543	1773	NA	NA	NA	NA	NA
S-9A	21	54	4' north	130	430	.6	2.5
S-20A	86	227	14' west	33	110	2.5	9.7
S-21A	54	97	14' south	35	120	2.4	8.8
S-1A	30	82	15' west	34	113	2.4	9.4
14B	612	2501	NA	NA	NA	NA	NA
S-8A	4	9	8' north	152	623	.1	2.8
S-21A	54	97	10' south	56	240	2.7	7.4
S-22A	54	101	10' east	56	240	2.7	7.4
S-23A	28	57	14' east	42	175	3.6	10.1

Note: Applicable cleanup standard is 730 ppm total PAH and 460 ppm total carcinogenic PAH.